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Transient engine performance of diesel and biodiesel blends at cold start

INTRODUCTION

Despite the improvement of technology in modern engines are remarkable in the past decades, the engine performance during cold start is still far from optimised because the cold ambient temperature has a significant effect on the air-fuel mixing, combustion and emissions. These effects lead to misfire cycles and the engine can't reach a stable idle speed quickly. The use of biodiesel blends which have different fuel properties deteriorates the cold start. Improving the transient engine performance of diesel and biodiesel blends at cold start is one of the key research areas involving most vehicle companies and oil industry.

RESEARCH OBJECTIVES

1. To improve understanding of the combustion behaviour and emission characteristics of diesel and biodiesel in cold start.
2. To investigate the effects of a variation of biodiesel (include TME, RME, UVOME, SME, HVO and etc. with different blend ratios of 10, 30 and 60%) in cold start at different ambient temperatures (30, 20, 10, 0, -5, -10, -15, -20 °C).
3. To optimise the cold start strategies with biodiesel-diesel blends.

TRANSIENT TEST FACILITY

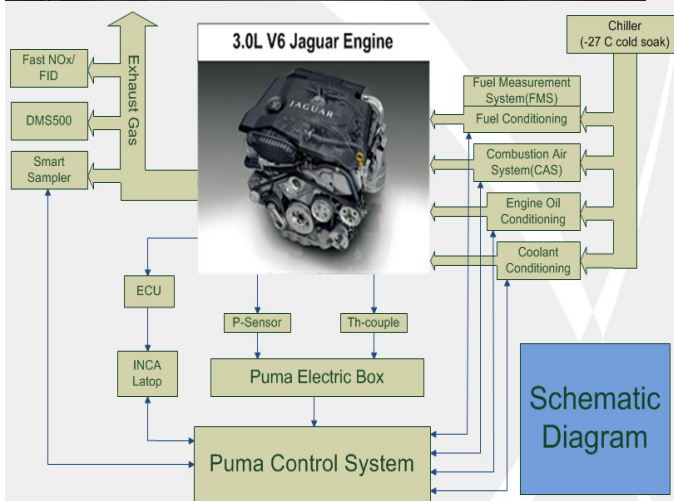
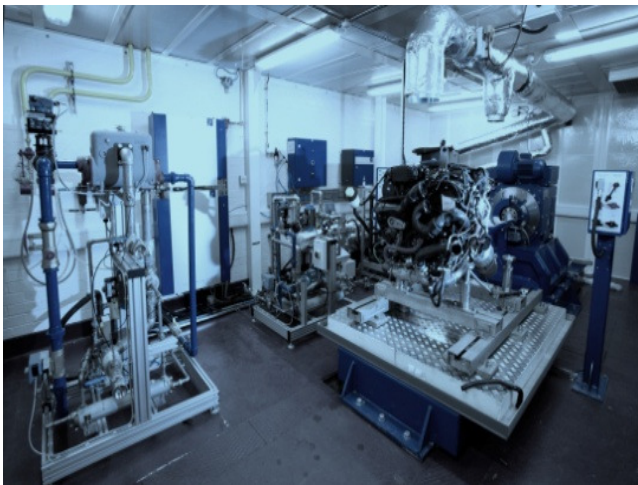


Figure 1. Cold Test Cell Schematic Diagram

Low Temperature Conditioning

The Chiller supplies minimum -27 °C cold soaking for fuel, combustion air, engine coolant and engine oil. The PUMA system controls the conditionings to cool the ambient temperature down to -20 °C by overnight soaking.

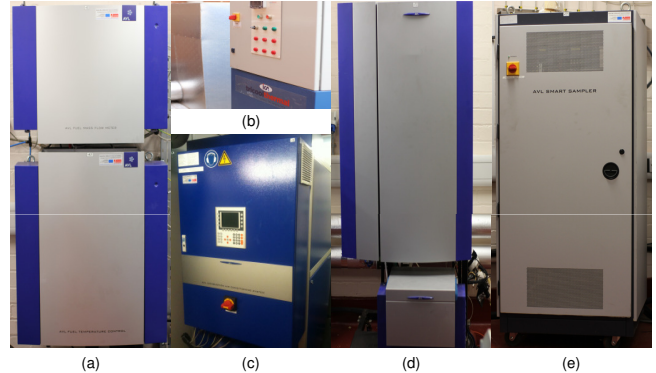


Figure 2. (a) AVL Fuel Meter and Temperature Controller. (b) Chiller. (c) Combustion Air System. (d) Exhaust Sample Dilutor and Filter. (e) Smart Sampler Cabinet.

Measurement

Particulate matter (PM) is one of the main problems for diesel engine emissions. AVL SPC 472 Smart Sampler provides gravimetric measurement of particulates and CAMBUSTION DMS500, Fast FID, Fast NOx measure all emission concentrations in real time, with PM measurement both in number and size.

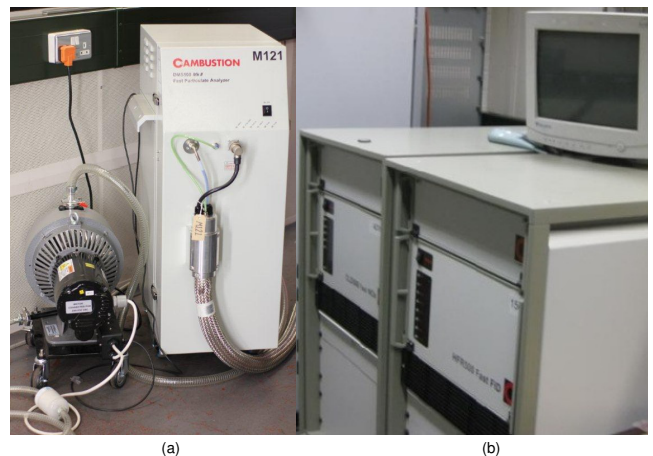


Figure 3. (a) Cambustion DMS500. (b) Cambustion Fast FID/NOx.

Future work

1. Baseline data generation for engine performance and emissions at various ambient temperatures.
2. Different biodiesel blends tests to assess the engine performance at cold start and transient conditions.
3. New control strategies development.